

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SEP 14 2004

Ms. Clara A. Moraga
Assistant Site Project Manager
Pine Bluff Chemical Agent Disposal Facility
57-210 Webster Road
Pine Bluff, AR 71802

Dear Ms. Moraga

This letter concerns the PCB concentration of the M55 Rocket Shipping/Firing Tubes to be used to calculate the PCB destruction and removal efficiency during the RCRA/TSCA Deactivation Furnace System Trial Burn at the Pine Bluff Chemical Disposal Facility (PBCDF). NPCD performed a statistical analysis (Enclosure) using data from past studies by the Army and data provided by PBCDF on the current rocket tube profile. This analysis indicate that the mean value for the PCB concentration of the rocket stockpile at PBCDF is 1484 ppm PCB. Separating the values for the matted and chopped tubes, the mean value of the matted rocket tubes is 1966 ppm PCB while the chopped tube has a mean value of 67 ppm PCB. PBCDF may use the overall mean value of 1484 ppm, or should PBCDF select to segregate the rockets having matted tubes from the chopped tube, PBCDF may use 1966 ppm PCB to calculate the PCB destruction and removal efficiency during the RCRA/TSCA Trial Burn, which will use only matted rocket tubes.

If you have further questions regarding this matter, please contact Hiroshi Dodohara of my staff at (202) 566-0507.

Sincerely,

/s/

Maria J. Doa, Ph.D.
Director
National Program Chemicals Division

Enclosure

cc: Jim Sales
EPA Region VI

CONCURRENCES

SYMBOL	7404T	7404T	7404T				
SURNAME	Dodohara	B-7	Doa				
DATE	9/8/04	9/8/04	9/13/04				

ROUTING SLIP

#	NAME	ACTION	INITIAL	DATE
1	Hiroshi Dodohara	Originator	<i>dd</i>	9/2/04
2	Tony Baney	Concur	<i>TB</i>	9/8
3	Brian Symmes	Concur	<i>BS</i>	
4	Maria Doa	Sign	<i>MD</i>	9/13
5	Pat Robinson	Administrative	<i>PR</i>	9/14
6				
7				
8				
9				

Nature of Item Being Routed:

Letter to Pine Bluff Chemical Agent Disposal Facility defining the levels of PCB content in the M55 Rocket tubes to use for DRE calculations during their Trial Burn. Pine Bluff's original request to use 2700 ppm PCB originated from the Johnston Island's demonstration permit. Tooele used 1274 ppm as a result of Utah DEQ's mandate to the Army to resample/reanalyze 1000 shipping tubes. Anniston used 6000+ ppm PCB because they separated the rockets and selectively used all matted-coated tubes during their second trial burn.

FROM:	DATE	TELE #	ROOM #
H. Dodohara	09/01/04	566-0507	EPA East 4353QQ



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

SEP 14 2004

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

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If you have further questions regarding this matter, please contact Hiroshi Dodohara of my staff at (202) 566-0507.

Sincerely,

A handwritten signature in cursive script that reads "Maria J. Doa".

Maria J. Doa, Ph.D.
Director
National Program Chemicals Division

Enclosure

cc: Jim Sales
EPA Region VI

Mean Levels of PCBs in M441 Rocket Tubes

8/31/04

Background

In Fall 2004, the Pine Bluff Arsenal plans to incinerate approximately 100,000 M441 rocket tubes. Previous testing has shown that these rocket tubes may contain PCBs at a level above 50 ppm. Under the Toxic Substances Control Act (TSCA), the incineration of tubes with PCBs above 50 ppm is required to meet a disposal efficiency known as the "six nines." The term "six nines" refers to the fact that the estimated percentage of PCBs incinerated is to be at least as high as 99.9999%.

One of the terms in the calculation of this percentage is the nominal level of PCBs in the stock of rockets that are incinerated. The nominal level is synonymous with mean level of PCBs in the rocket tubes. The determination of the mean level of PCBs for use in the calculation of this percentage is the goal of this project.

Information Available

The US Army has collected information on PCB levels in M441 rocket tubes in the late 1980s and early 1990s. Three reports with data in paper format were available for review. (These reports were "Interim Report Research and Development Tests to Dispose of Polychlorinated Biphenyls (PCBs) at the Chemical Agent Munitions Disposal System" dated April 1986; "Appendix D M441 Tube Analysis Data" dated February 1987"; and "Attachment III-1 AEHA Hazardous Waste Study - Phase 3" dated July 1993.) Rocket tube samples were collected in what appears to be non-probability sample, largely collected at a single facility. Four types of rocket tubes were identified: chopped, matted, matted coated, and chopped coated. The terms "chopped" and "matted" refer to the type of fiberglass in the rocket tubes. There were 147 chopped tube samples and 2000 matted tube samples analyzed in the available reports. In the previous work, no pattern between the results and rocket lot number was identifiable. No distinction was made between results for coated and uncoated tubes.

At the Pine Bluff Arsenal, the total number of rocket tubes for incineration is 109,761. Of these, 77,800 are matted, 4095 are matted coated, and 27,866 are chopped. For this project, the matted and matted coated rockets will be combined into a single category, designated as matted.

Chopped Rocket Tube Data Analysis

Results from one hundred forty-seven samples from chopped rocket tubes were available. Almost all results were reported as less than 10 ppm. Only three results were reported as above 50 ppm. These three results were: 84 ppm, 4500 ppm, and 4500 ppm. Hence the distribution of data showed almost all results less than 10 ppm, two results out of 147 to be equal to 4500 ppm, and five results in between (84, 37, 28, 13, and exactly 10 ppm).

The data were entered into an Excel spreadsheet. Data entries were compared to the paper copy of the data. Discrepancies were corrected in the file.

The mean for the chopped rocket tubes was calculated under two scenarios. Under the first, the "less than" sign was discarded, and the mean calculated for all the numerical values. Under the assumption that 10 ppm was the limit of detection, this corresponds to using the limit of the detection to represent the result for cases below a detection limit of 10. The mean in this case was 72 ppm. Under the second, for all cases where a "less than" sign was present, the associated numerical value was divided in half, and the mean computed for the resulting data. This corresponds to using half the limit of detection for cases where the result was non-detection. The mean in this scenario was 67 ppm.

The mean for scenario two is recommended for this project. This approach for non-detected data has been used in this office previously. The standard deviation for scenario two was 522 ppm. Under scenario two, the mean of 27,866 chopped rocket tubes is estimated to be 67 ppm, and the standard error of the mean of 27,866 chopped rocket tubes is estimated to be 3 ppm.

Matted Rocket Tube Data Analysis

There were two data sets for matted rocket tubes, each with 1000 nominal data values. Hence there was far more data for matted tubes than for chopped tubes. The data for each of the two matted sets was entered into separate Excel spreadsheets. For data set 1, four entries were missing from the data, at observation numbers 283, 327, 333, and 699. For observation 327, a handwritten notation of "<10" was observed in the report. For the other three cases, review of the nearby entries suggested that "<10" was most likely result since all the nearby entries had this value, and it was likely a single "<10" was inadvertently omitted from a group of identical entries. For observation number 300, a value of 4020 was apparently intended, as shown by an overstrike of a leading digit of "2 " by a "4." The value of 4020 was entered. Visual comparisons between the entered data and the data sheets were made, and discrepancies

corrected. For the second set of data, a column labeled "Composite (Calculated)" was used as a quality assurance check on data entry. A correspondence between the PCBs result column and the composite column was noted, and provided a means of checking on data entry. This check was useful as a quality assurance check on certain cases where a "5" and a "6" were difficult to distinguish.

The previous reports contained statistical results for these two data sets. An attempt was made to reproduce these statistics as a further quality assurance check. In these calculations, all the less than signs were ignored, and only the numerical part of the result used. The results for the first matted data set are in the table below.

Table 1: Comparison of Report Values to Calculated Values from Entered Data for First Set of Matted Rocket Tubes

Matted Data Set 1		
Statistic	Report Values	Calculated from Entered Data
Mean first 200 samples	2086	2078
Standard Deviation first 200	1789	1792
Mean first 400 samples	1515	1505
Standard Deviation first 400	1755	1754
Mean first 600 samples	1390	1384
Standard Deviation first 600	1710	1709
Mean first 800 samples	1510	1503
Standard Deviation first 800	1728	1728
Mean all 1000 samples	1802	1778
Standard Deviation all 1000	1763	1738
Number <10 ppm for Ids 1-921	425	429
Number < 50 ppm for Ids 1-921	470	472
Number Between 10 and 49 ppm for Ids 1-921	45	43

Number Between 50-1999 ppm for Ids 1-921	3	4
Number >2000 ppm for Ids 1-921	445	445
Number <10 ppm for Ids 922-1000	0	0
Number < 50 ppm for Ids 922-1000	0	0
Number Between 10 and 49 ppm for Ids 922-1000	0	0
Number Between 50-1999 ppm for Ids 922-1000	0	0
Number >2000 ppm for Ids 922-1000	79	79
Sample Mean of Results >2000 ppm for Ids 1-921	3370	3374
Standard Deviation of Results >2000 ppm for Ids 1-921	591	591
Sample Mean of Results >2000 ppm for Ids 922-1000	3410	3410
Standard Deviation of Results >2000 ppm for Ids 922-1000	690	684

The differences were reviewed, and the entered values double-checked. No errors were found in data entry.

The count statistics for the first 921 identification numbers were reviewed. The previous report statistics added to 918 instead of 921. The corresponding counts were adjusted to remove three "<10" values to provide comparable counts. It was noted that one value was exactly equal to 50, and this value was likely incorrectly classified in the 10-49 group and the <50 group. These two points explained some of the differences seen. The reason for the remaining differences could not be determined.

Because four missing values were assumed on the available evidence to be <10 ppm, the means for groups of 200, 400, 600, 800, and 1000 samples

were recomputed with missing values for entries 283, 327, 333, and 699. See Table 2 below. The table shows that differences in means and standard deviations either decreased or stayed the same when this was done. Hence it is plausible that the original calculations were done with missing values instead of the value of 10. However, differences still remained for the first and last groups in the table. Since no errors were found in data entry after the last check, it was concluded that the previous report calculations contained either rounding error or some unexplainable calculation or classification error.

Table 2: Comparison of Report Values to Calculation Values with Missing Values Left at Missing for First Set of Matted Rocket Tubes.

Category	Report Value	Calculated Value (with missing values)
Mean first 200	2086	2078
Standard Deviation first 200	1789	1792
Mean first 400	1515	1516
Standard Deviation first 400	1755	1756
Mean first 600	1390	1391
Standard Deviation first 600	1710	1711
Mean first 800	1510	1510
Standard Deviation first 800	1728	1729
Mean all 1000	1802	1785
Standard Deviation all 1000	1763	1738

The four cases of missing values were all kept at a value of <10 for the final data set. For this final data set, the mean for the first set of matted rockets was calculated under the two scenarios above. The means were 1778 and 1776 ppm, respectively. The standard deviation for the second scenario is 1740 ppm.

For the second matted data set, a table comparing previous report values to values calculated from the entered data is below.

Table 3: Comparison of Report Values to Calculated Values from Entered Data for the Second Set of Matted Rocket Tubes.

Matted Data Set 2		
Statistic	Report Values	Calculated from Entered Data
Number <10 ppm for lds 1001-1470	318	315
Number < 50 ppm for lds 1001-1470	342	342
Number Between 10 and 49 ppm for lds 1001-1470	24	27
Number Between 50-1999 ppm for lds 1001-1470	4	4
Number >2000 ppm for lds 1001-1470	124	124
Number <10 ppm for lds 1471-1500	15	15
Number < 50 ppm for lds 1471-1500	23	23
Number Between 10 and 49 ppm for lds 1471-1500	8	8
Number Between 50-1999 ppm for lds 1471-1500	0	0
Number >2000 ppm for lds 1471-1500	7	7
Number <10 ppm for lds 1501-2000	9	9

Number < 50 ppm for Ids 1501-2000	16	16
Number Between 10 and 49 ppm for Ids 1501-2000	7	7
Number Between 50-1999 ppm for Ids 1501-2000	3	3
Number >2000 ppm for Ids 1501-2000	481	481
Sample Mean of Results >2000 ppm for Ids 1001-1470	3620	3624
Standard Deviation of Results >2000 ppm for Ids 1001-1470	777	767
Sample Mean of Results >2000 ppm for Ids 1001-1470	3390	3386
Standard Deviation of Results >2000 ppm for Ids 1001-1470	650	649
Sample Mean of Results >2000 ppm for Ids 1001-1470	3470#	3469*
Standard Deviation of Results >2000 ppm for Ids 1001-1470	690#	686*

- likely does not include outlier of value 13,000 ppm

* - excludes outlier of value 13,000 ppm

The data entries reviewed again for errors. No data entry errors were found. The differences were attributed to rounding error or unexplained calculation or classification error in the previous reports.

The means were calculated under the two scenarios above. The means were 2156 ppm in both cases. The standard deviation for the second scenario is 1821 ppm.

The overall estimated mean for the matted rocket tubes is $(1776+2156)/2$ or 1966 ppm. The overall standard deviation is 1791 ppm. The mean of the 81,895 matted rocket tubes is therefore estimated to be 1966 ppm with the standard error of this mean estimated to be 6 ppm.

Combination for Pine Bluff

If a single mean is desired for the Pine Bluff M441 rocket tubes, the recommendation is a weighted average of the two means for chopped and matted, with the weights equal to the number of rocket tubes in each category. This weighted average is 1484 ppm. The standard error for the weighted mean is estimated to be 5 ppm.

If separate means are desired for each of the categories chopped and matted, the chopped mean is 67 ppm and the matted mean is 1966 ppm.

A table summarizing the means, standard deviations, and standard errors of the means appears below.

Table 4: Summary of Means, Standard Deviations, Standard Errors for Rocket Tube Categories.

Category	Number of Tubes	Mean (in ppm)	Standard Deviation (in ppm)	Standard Error of Mean (in ppm)
Chopped Only	27,866	67	522	3
Matted Only	81,895	1966	1791	6
Chopped and Matted Weighted	109,761	1484	Not Applicable	5

Disposal Efficiency Calculation

The disposal efficiency equation includes the nominal level of PCBs as one of the parameters in the equation. It is apparently the practice to use the estimated mean level of the PCBs in the rocket tubes as the nominal value of the PCBs. Since there are a large number of rocket tubes, the standard error of this mean is relatively small.

All the means listed in Table 4 above achieve six nines in the DRE equation provided for this project. In fact, the DRE equation as presented with the nominal values of 40 rockets per hour and maximum detection limit of 0.5 achieves six nines for nominal PCB values as low as 42 ppm.

Conclusion

If chopped and matted rockets are incinerated separately, the nominal PCB value for the DRE equation is 67 ppm for the chopped rocket tubes and 1966 ppm for the matted rocket tubes.

If chopped and matted tubes are incinerated together, the nominal PCB value for the DRE equation is 1484 ppm.

Contact

For questions or comments about the data entry and statistical calculations, contact:

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